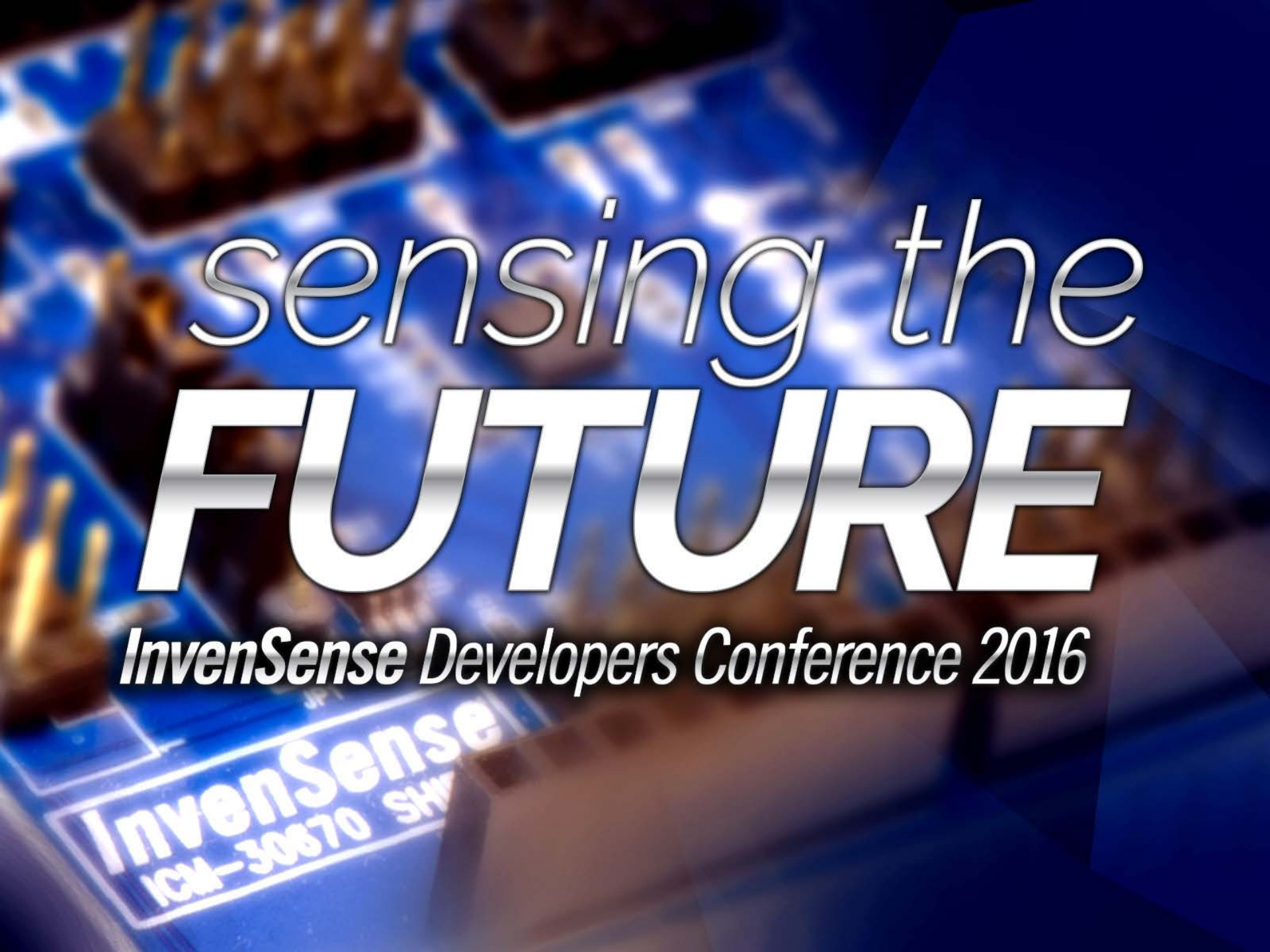
sensing the
FUTURE
InvenSense Developers Conference 2016
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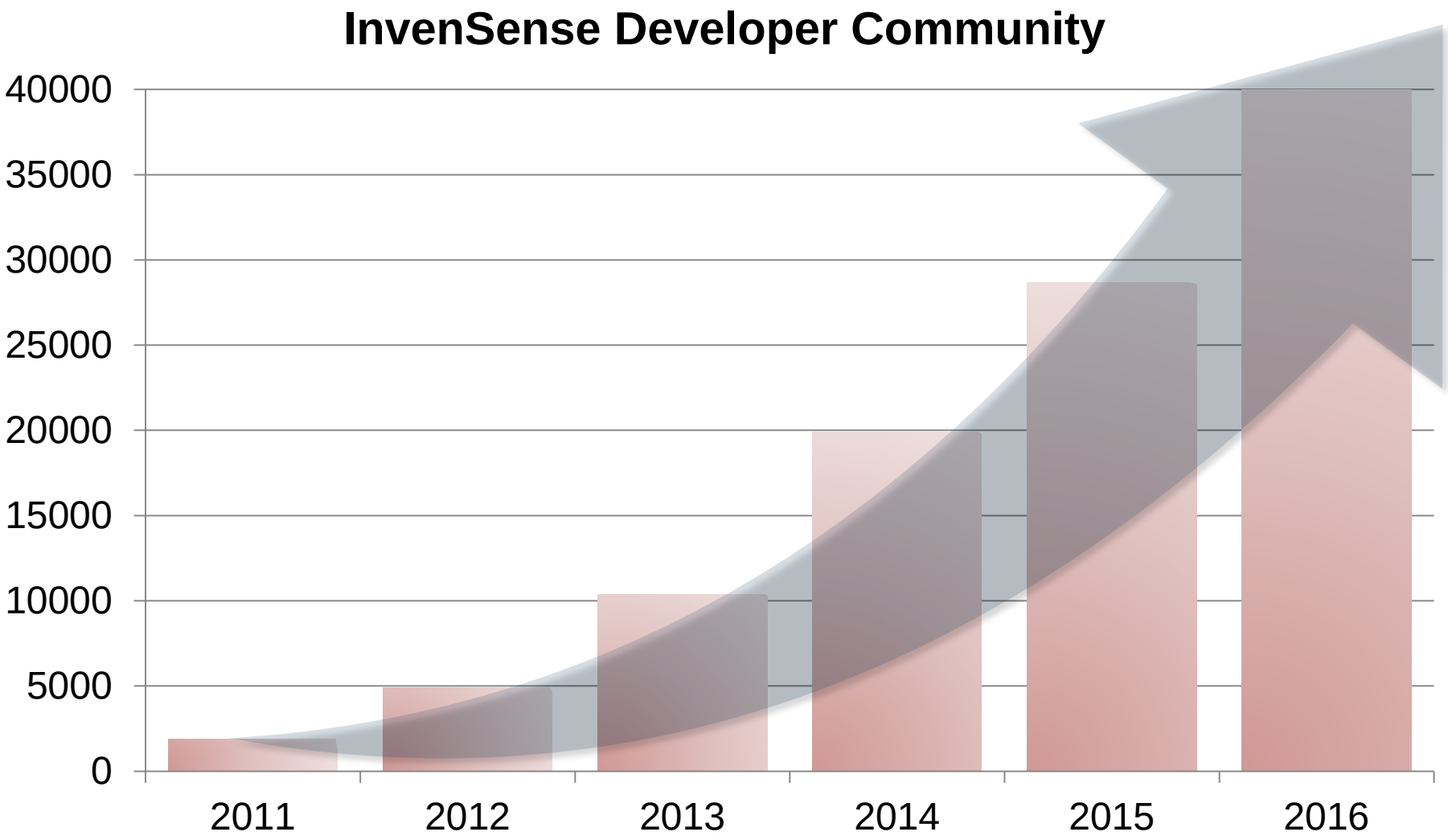
ICM-30670

A Growing Community

sensing the FUTURE



The Last Decade - Mobile Computing

sensing the FUTURE

GPS Nav

OIS

A/V

Motion

EIS

Media Rich

Sensor Rich

Cloud Connected

Location Aware

The Mobile Economy - A Virtuous Cycle

Authentication

The Mobile Economy - A Virtuous Cycle

Authentication

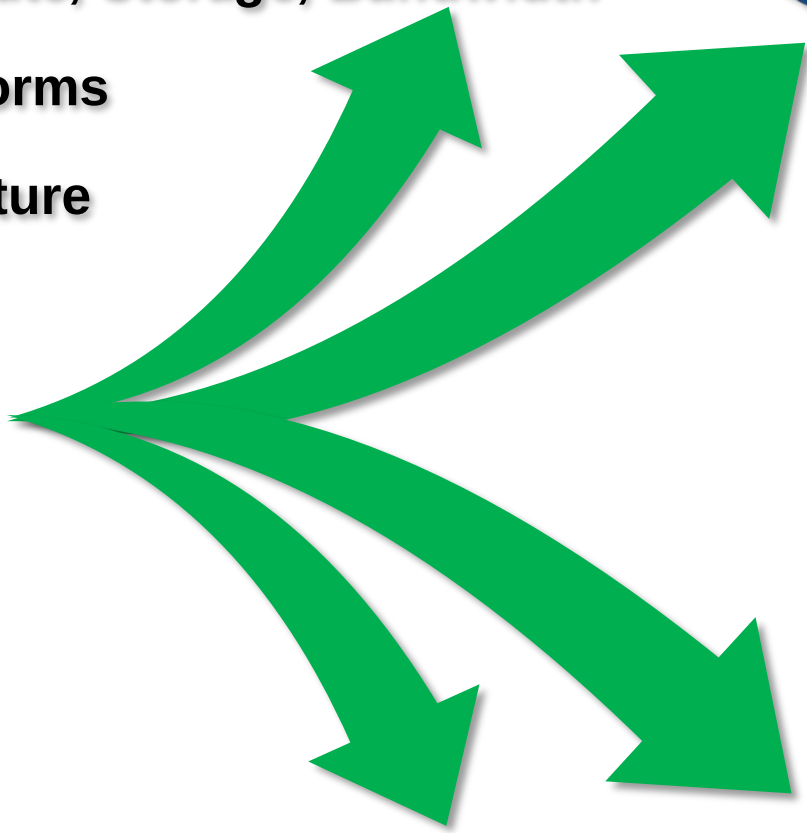
The Next Decade - Ambient Computing

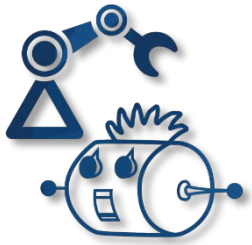
sensing the FUTURE

Much more Compute, Storage, Bandwidth

Sensor Rich Platforms

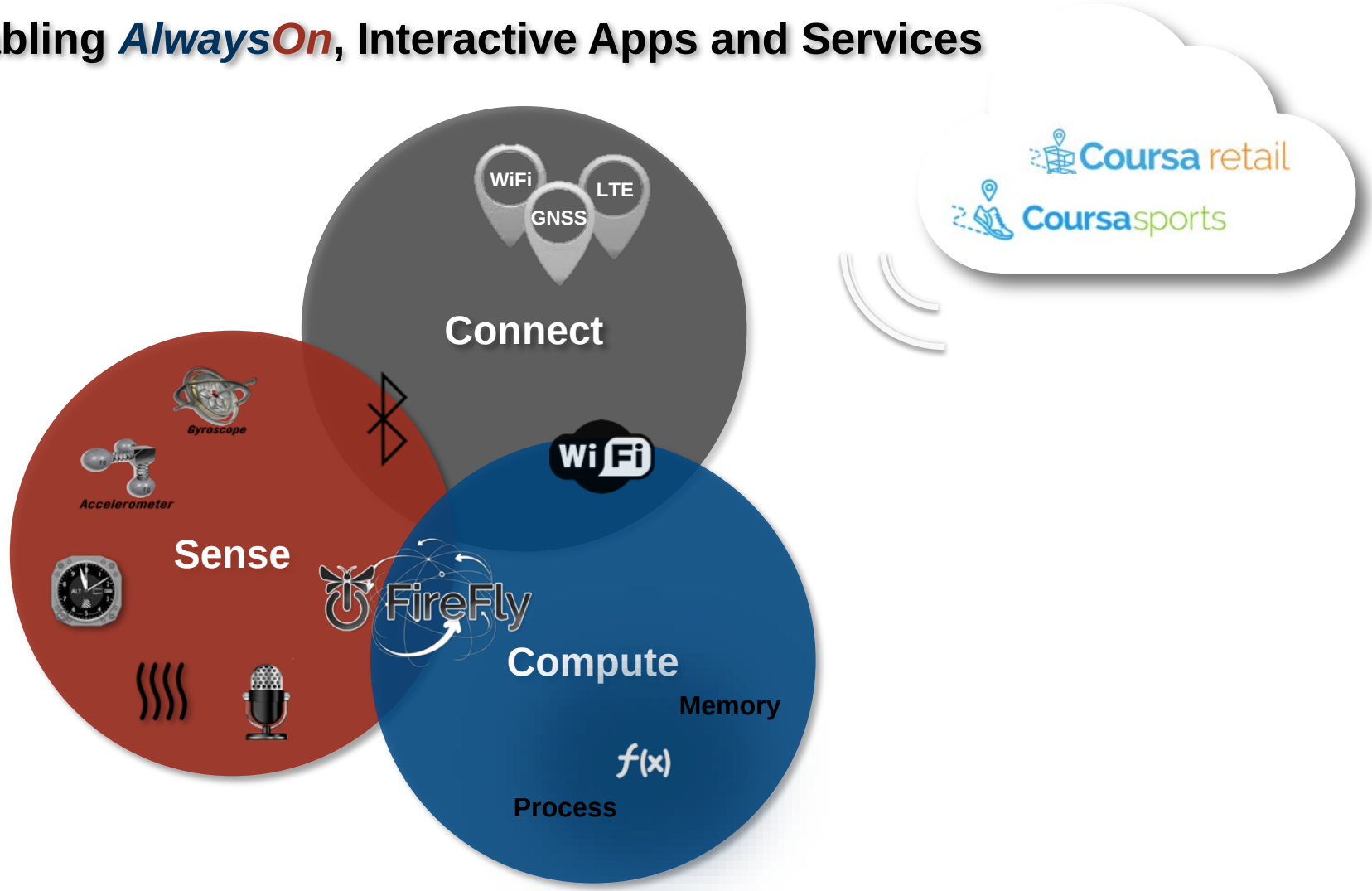
Mobile Cost Structure





Ambient Computing - Internet of Sensors

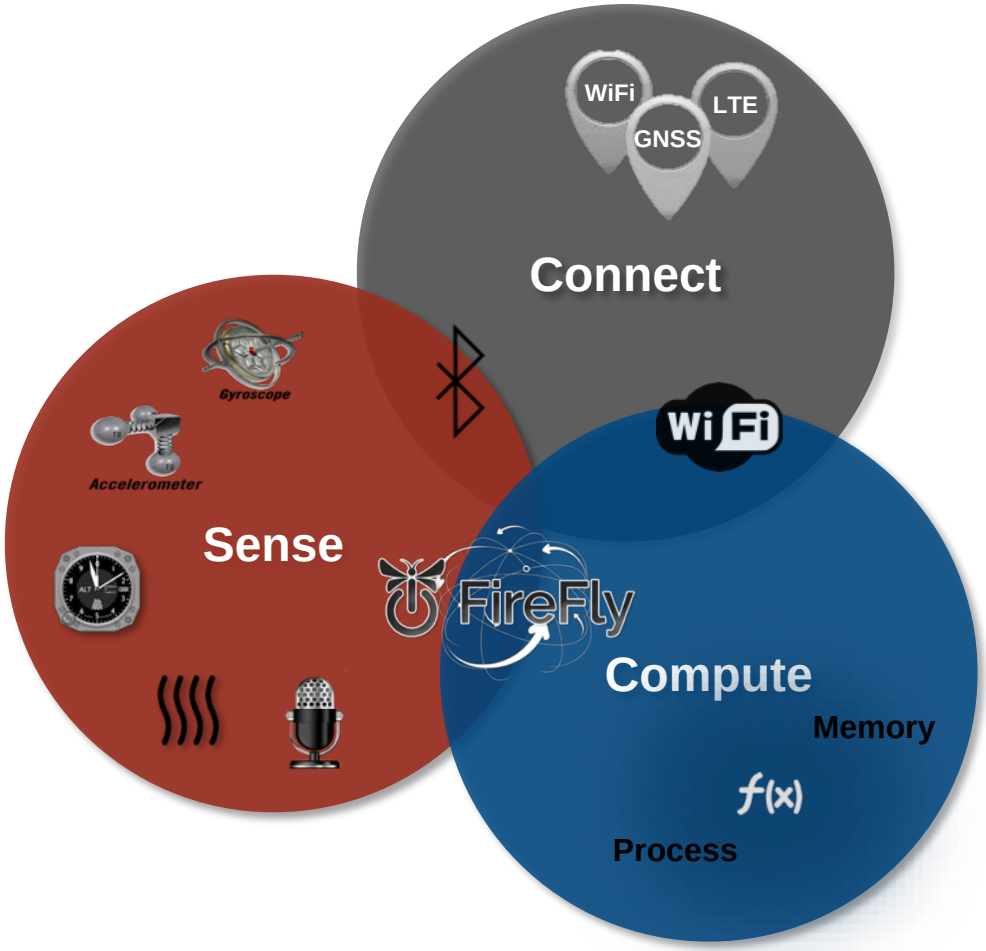
Enabling *AlwaysOn*, Interactive Apps and Services



Ambient Computing - Internet of Sensors

sensing the FUTURE

Enabling *AlwaysOn*, Interactive Apps and Services

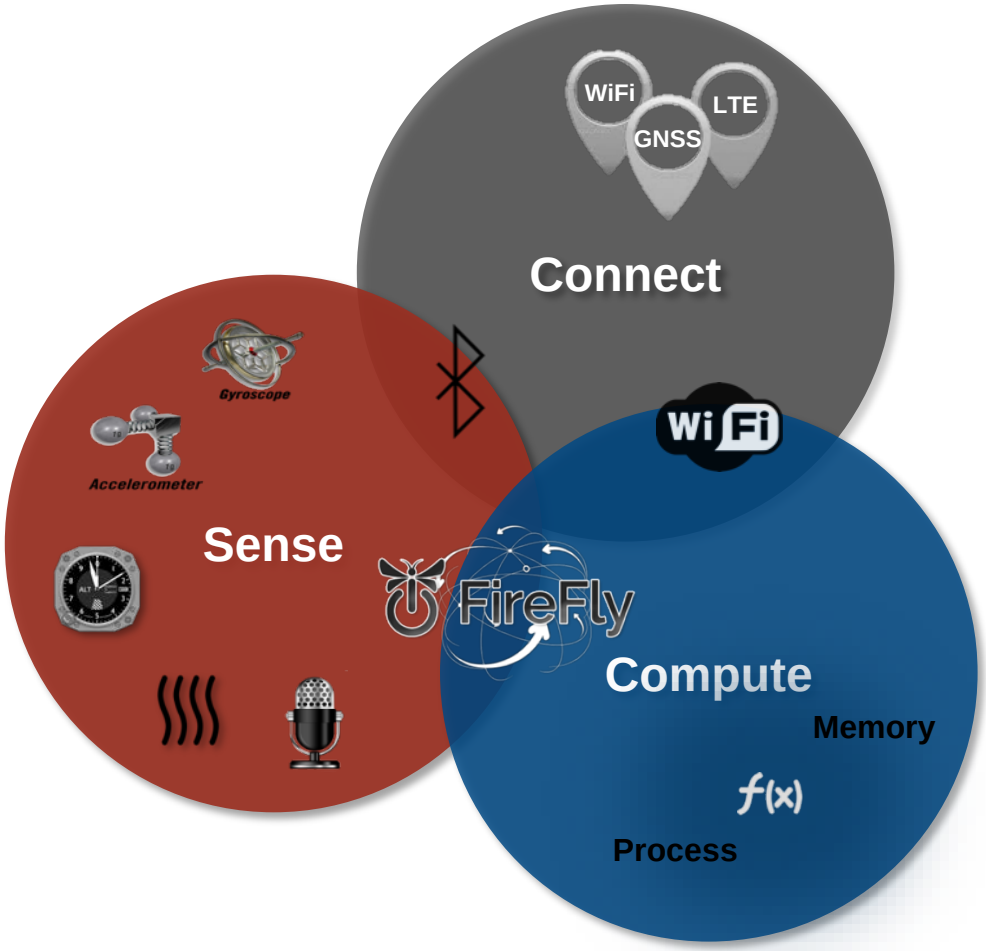


- **Performance**
- **Power**
- **Size**

Ambient Computing - Internet of Sensors

sensing the FUTURE

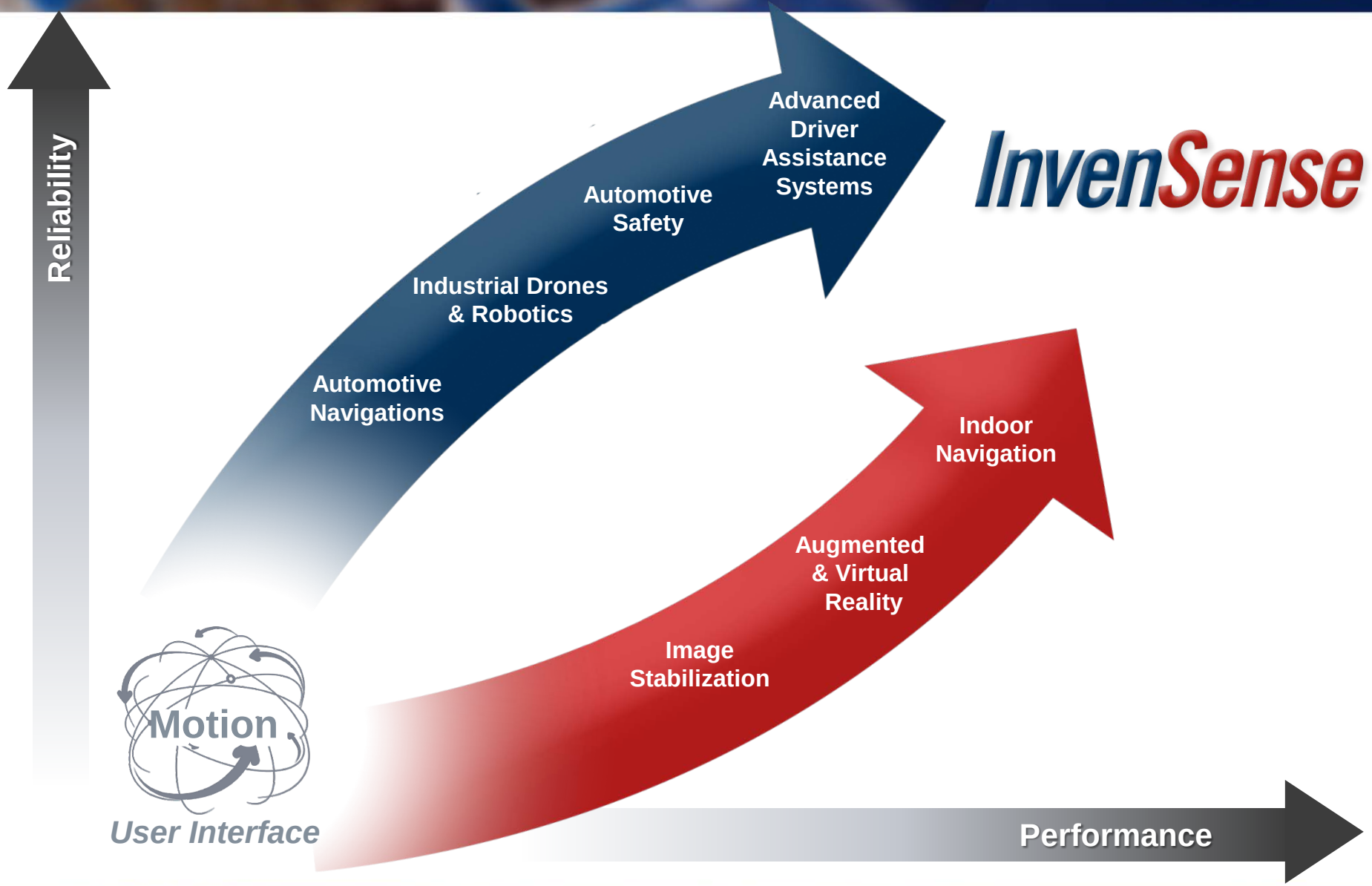
Enabling *AlwaysOn*, Interactive Apps and Services



- **MEMS Stability**
- **System Solution**
- **Integration**
  - Multi-sensory
  - SoC Features

Performance Matters

sensing the FUTURE

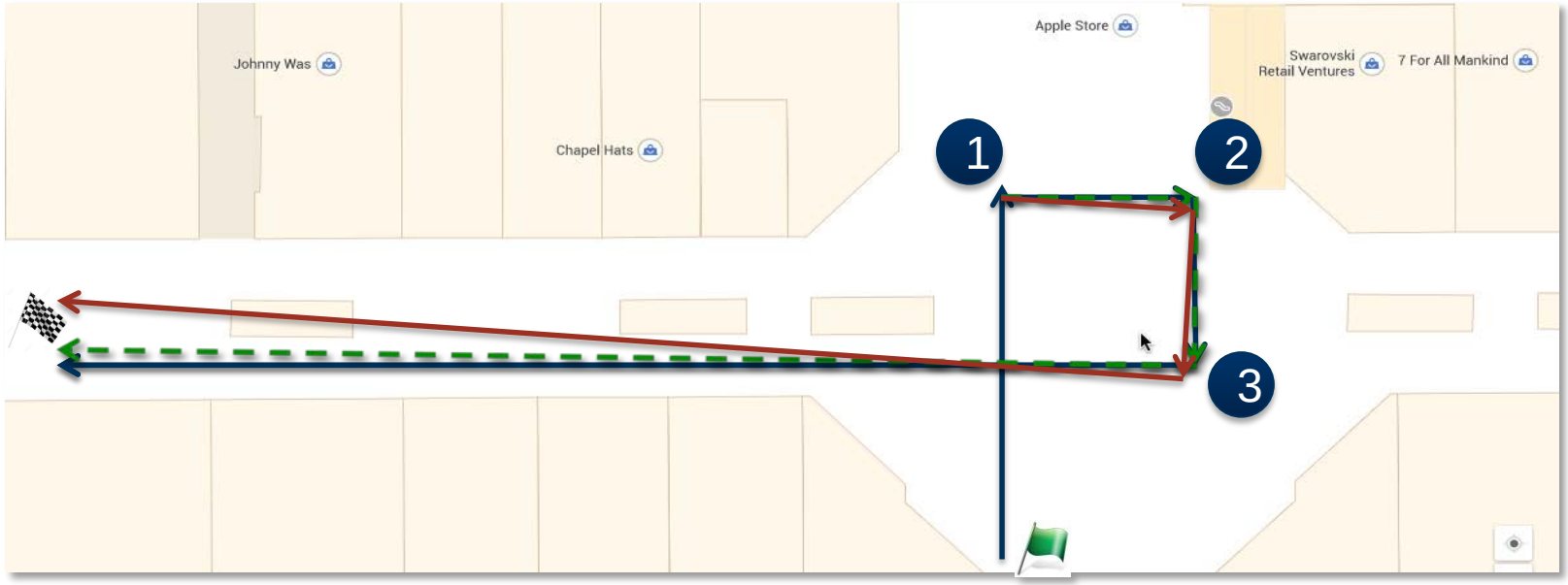


InvenSense

Performance Matters

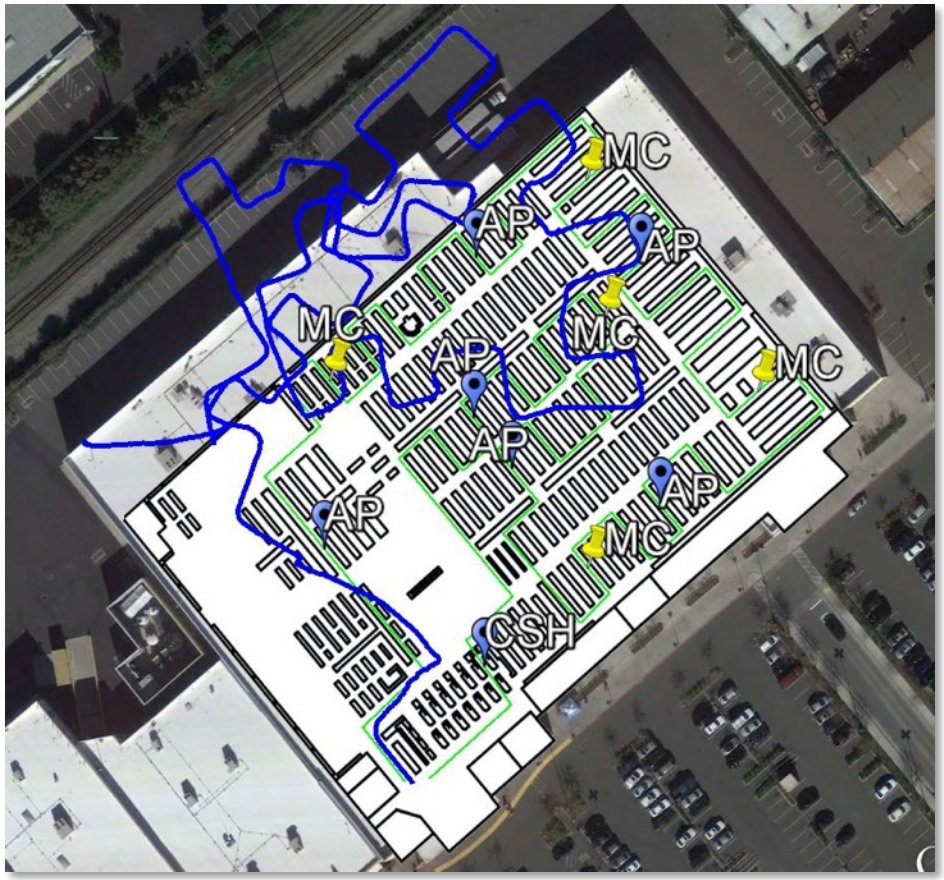
sensing the FUTURE

PDR accuracy limited by Inertial Sensor Performance



Indoor Navigation along a 500ft path including 3-turns

Store Test

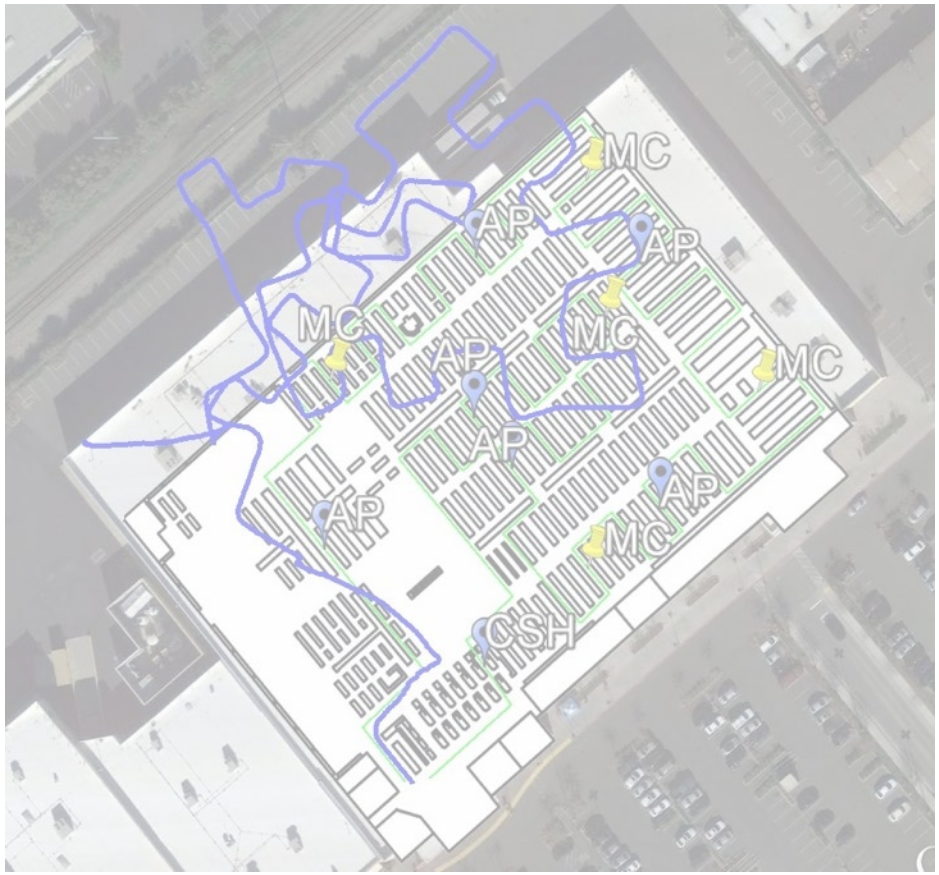


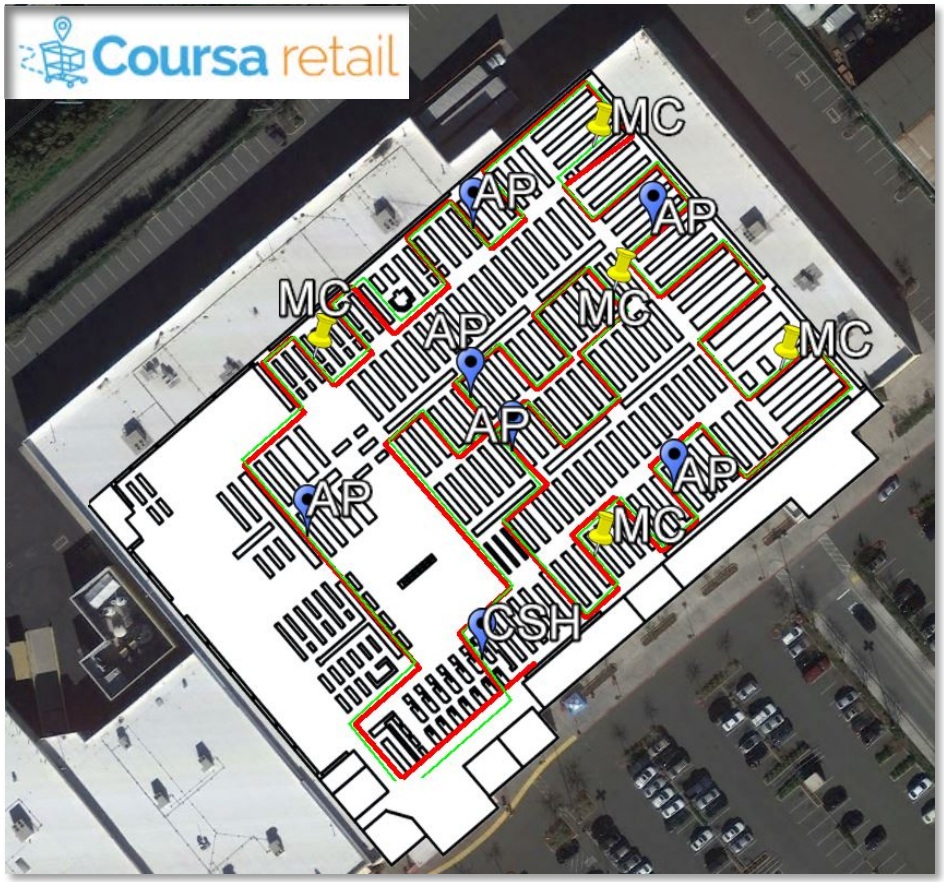
- **Session length: 20mins.**

Reference Real-Time

Store Test with CoursaRetail

sensing the FUTURE





- **Session length: 20mins.**
- **Aisle Accuracy, <2m in Aisle Accuracy**

Reference Real-Time

Post-Processed

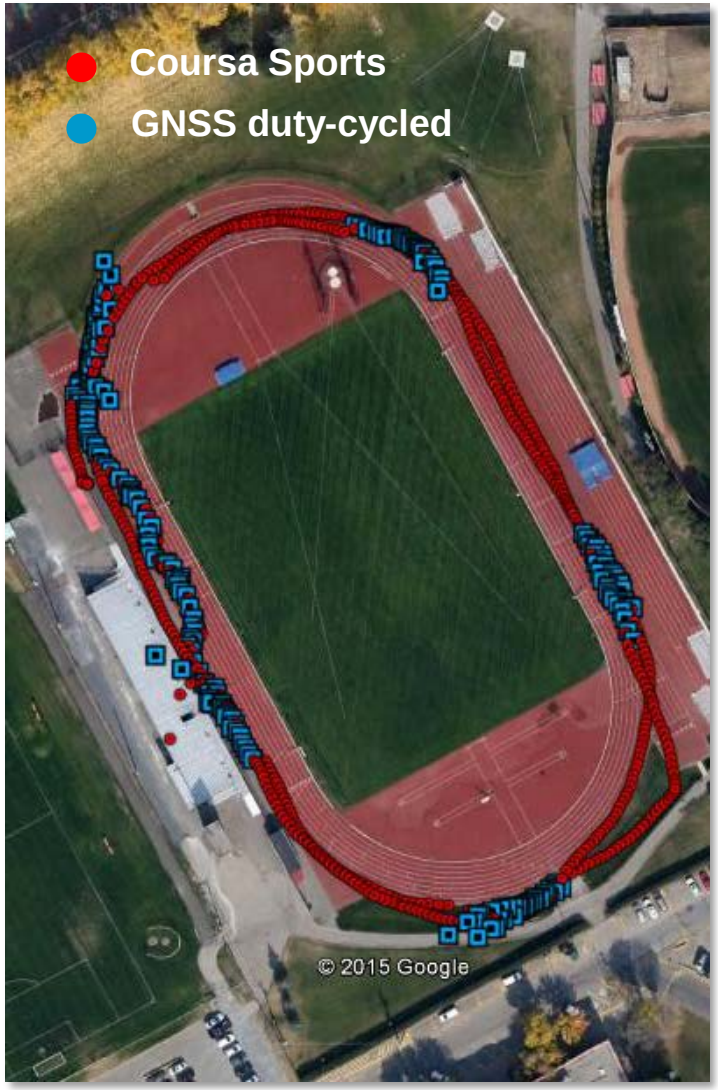
Location Solution - Performance and Power

sensing the FUTURE

Coursasports

GNSS Duty-Cycling

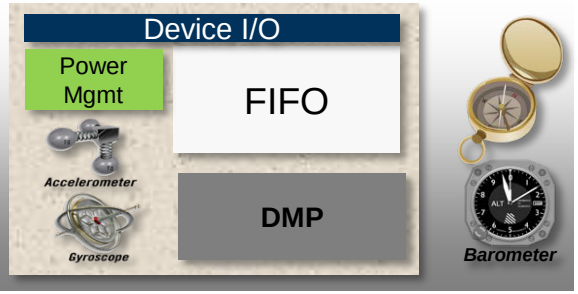
- **Up to 50% System Power Reduction**
  - GNSS power ~ 10-15m
  - IMU + SW stack <2mA
- **Full Coverage**
- **Increased Accuracy**



Integration

sensing the FUTURE

High Performance
6-Axis
9-Axis
7-Axis



Inertial

High Performance

- High SNR
- Low Power Analog
- Low Power PDM
- Top/Bottom Port

Audio

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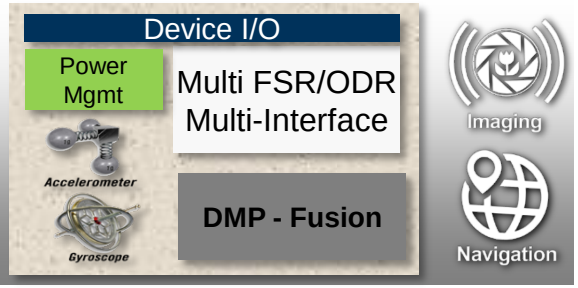
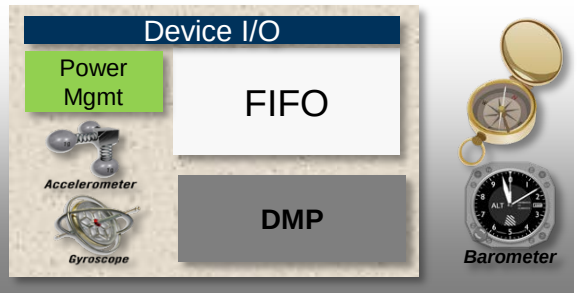
Integration

sensing the FUTURE

Feature Rich



High Performance 6-Axis/ 9-Axis 7-Axis



Inertial

Digital Beam Forming

- 72dB< SNR
- Low Power PDM/I2S
- TDM

High Performance

- High SNR
- Low Power Analog
- Low Power PDM
- Top/Bottom Port

Audio

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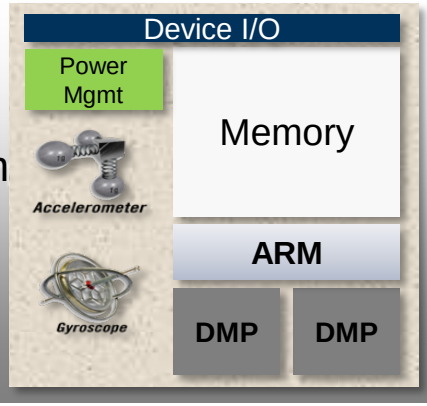
Integration

sensing the FUTURE

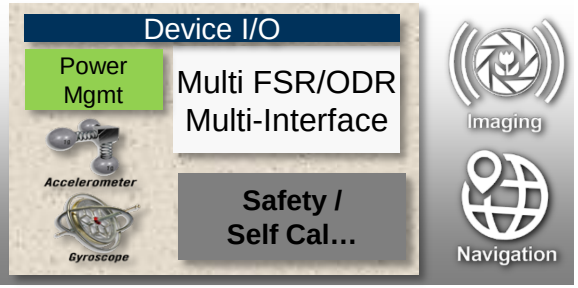
FireFly

Open Platform IoT

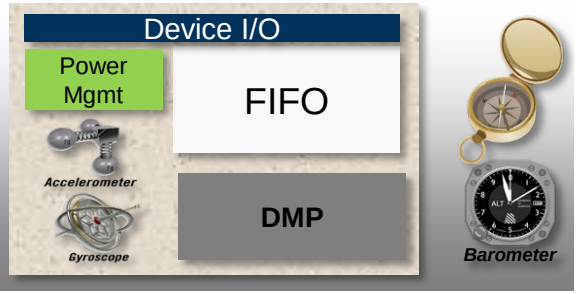
Sensor STUDIO



High Feature



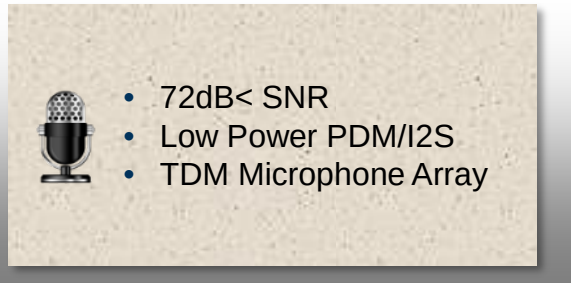
High Performance 6-Axis/ 9-Axis 7-Axis



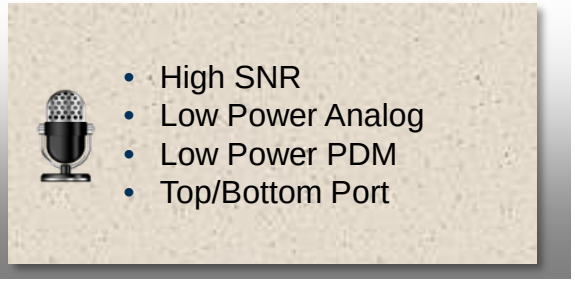
Inertial

Digital

Beam Forming



High Performance



Audio

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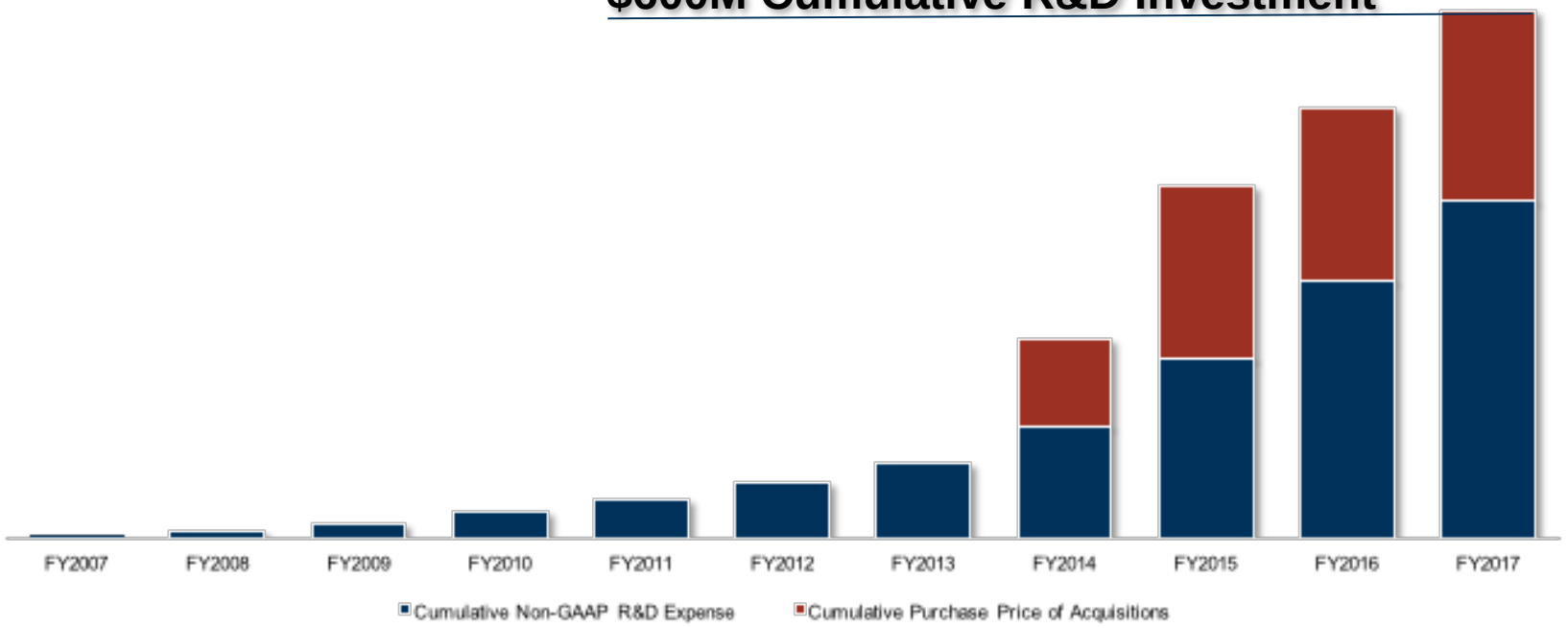
A History of Innovation

sensing the FUTURE

$600M Cumulative R&D Investment



2003
Founded

2006
World's First Consumer OIS

2009
Motion Gesture leadership

2010
World's First 6-Axis

2011
World's First 9-Axis Fusion

2013
World's First 9-Axis

2014
Flagship Win
World's 1st ARM+DSP Hub

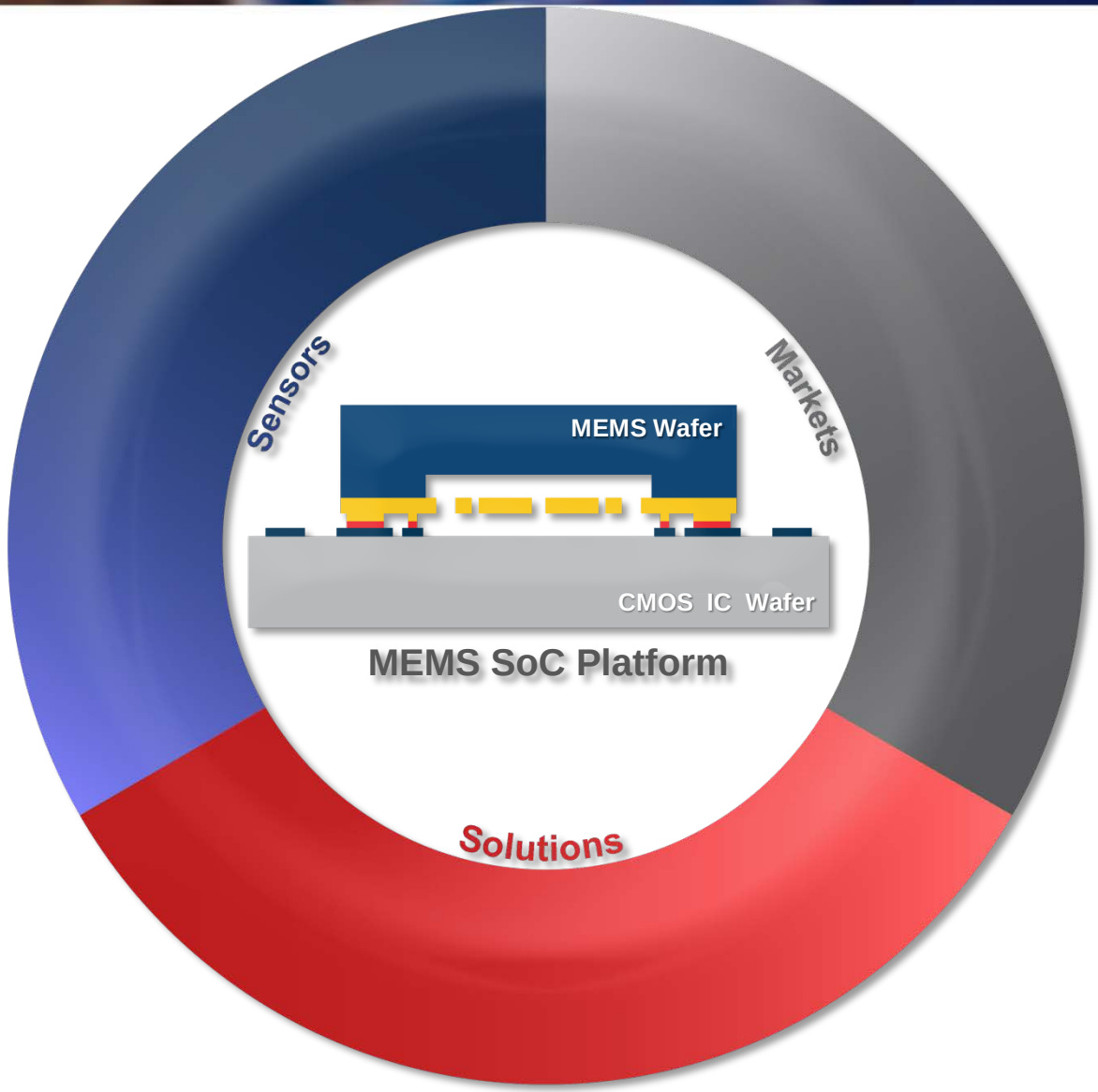
2015
1B units shipped
World's First Dual interface 6-Axis

2016
#1 Consumer Motion
IHS Q1'16 MEMS Report

InvenSense

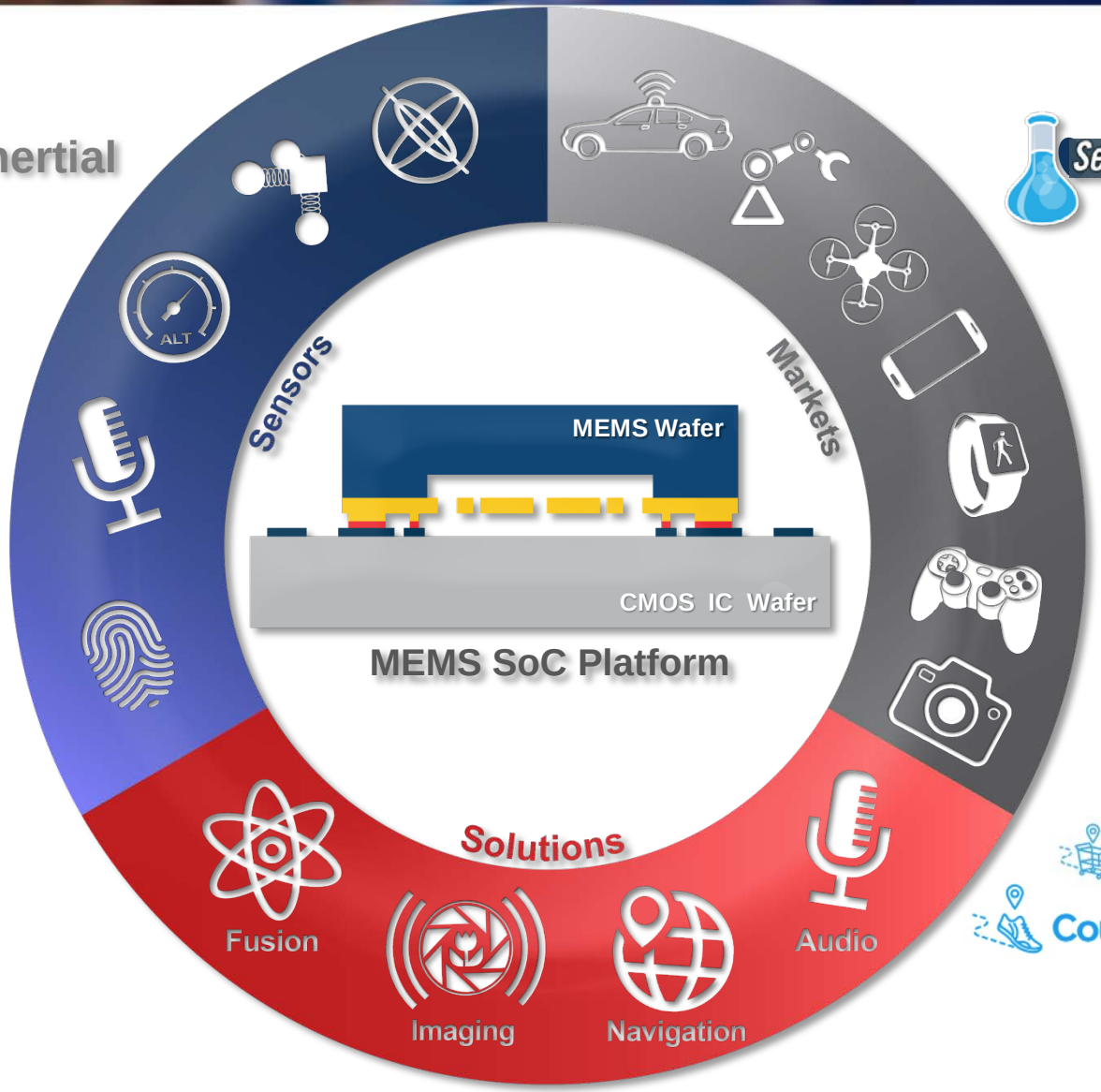
Platform Strategy

sensing the FUTURE



Platform Strategy

sensing the FUTURE



Sensor STUDIO

FireFly

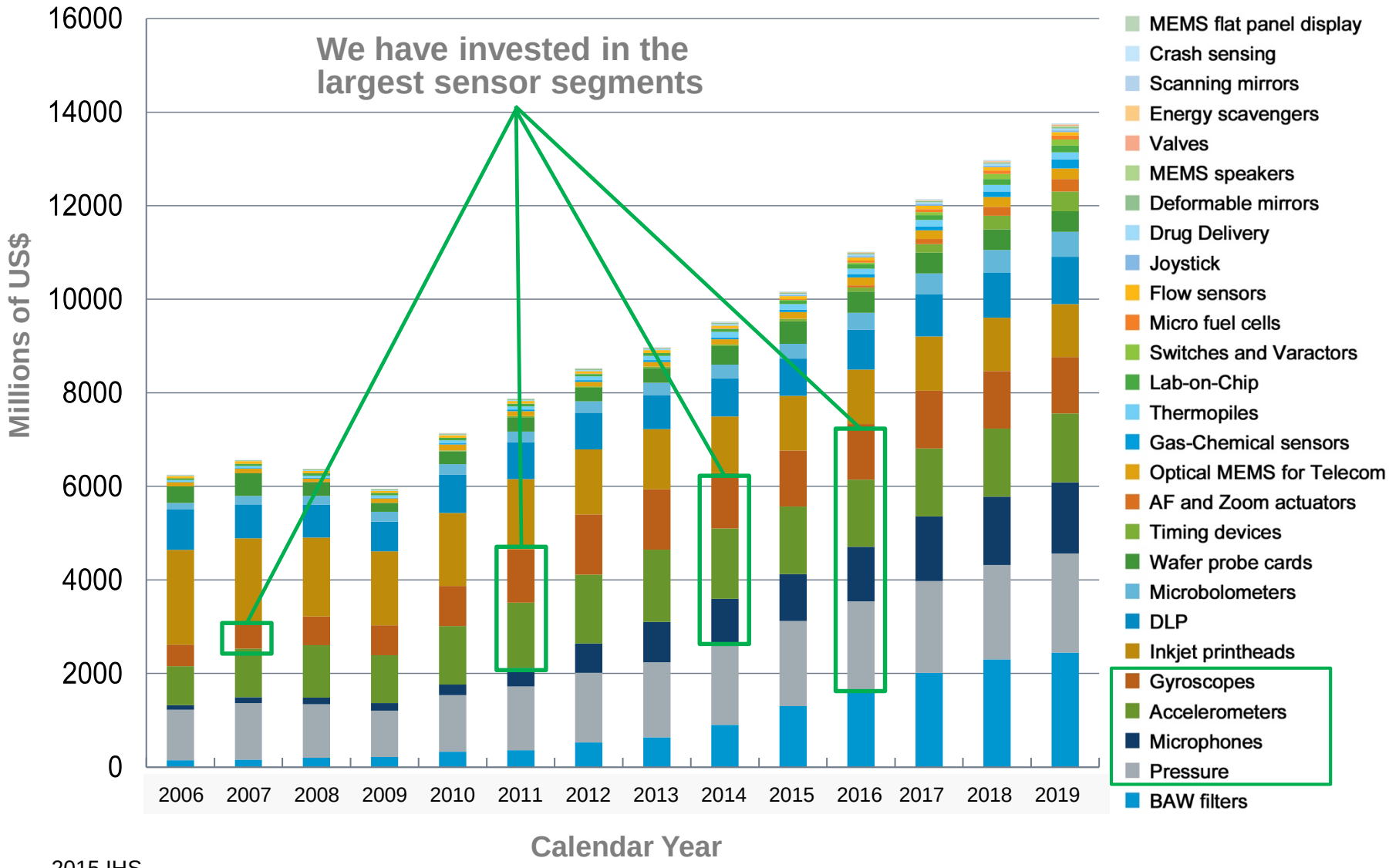
Coursa retail

Coursasports

InvenSense

MEMS Market by Device

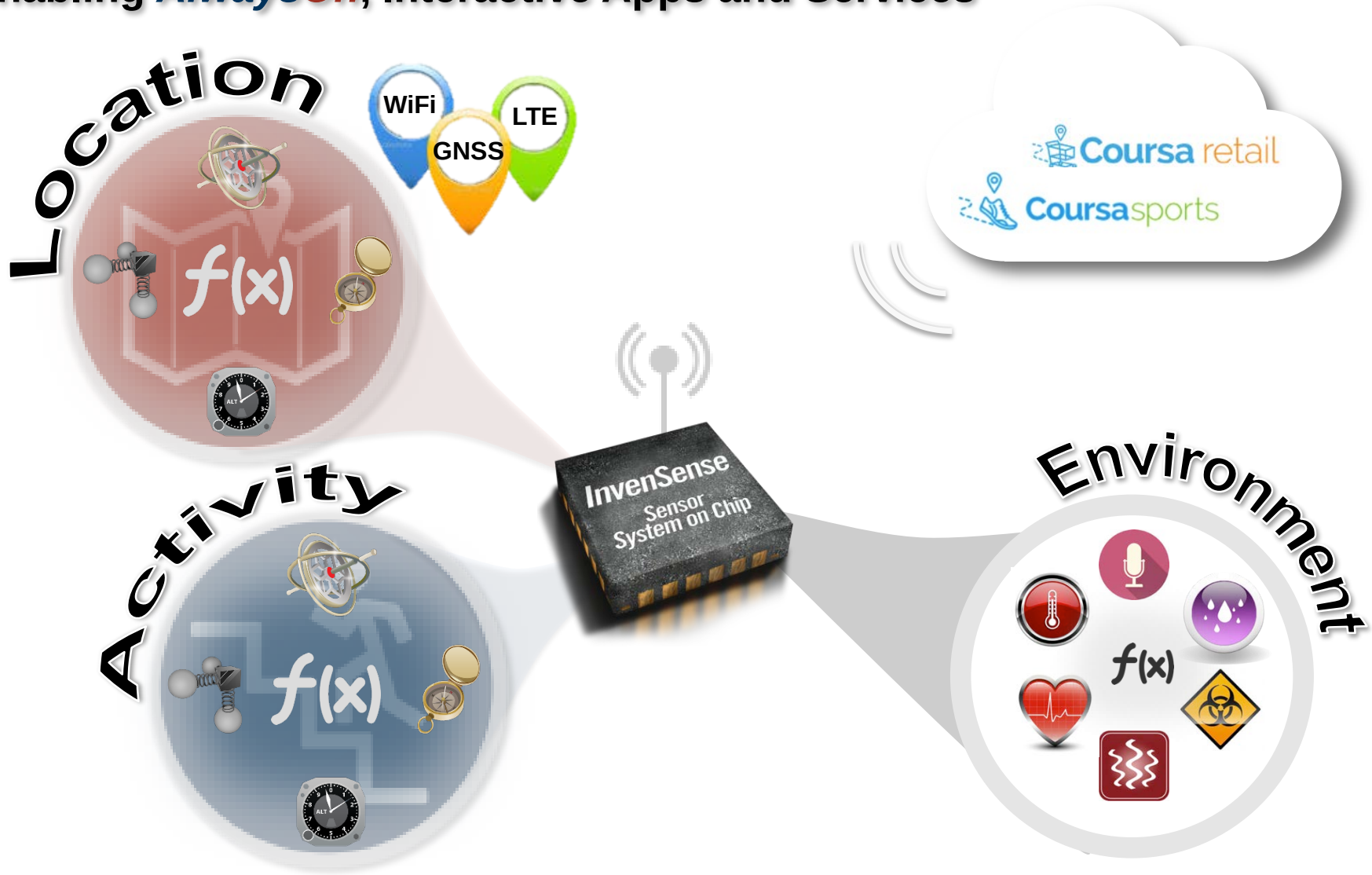
sensing the FUTURE



2015 IHS

InvenSense

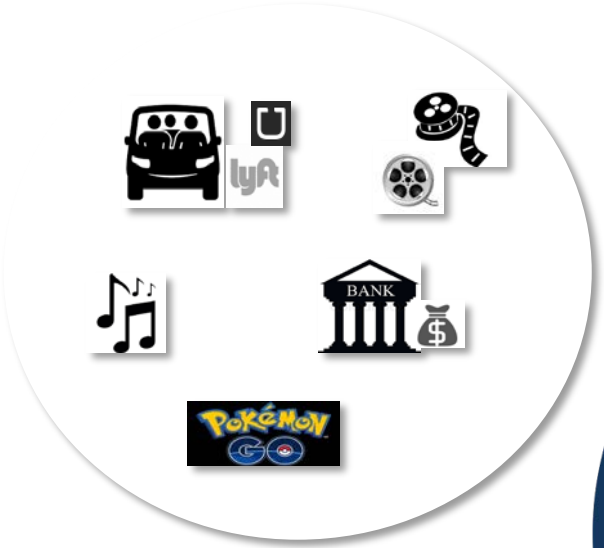
Enabling *AlwaysOn*, Interactive Apps and Services




Context…
Learn
Navigation
Feedback
Device I/O
Power Mgmt
Memory
Accelerometer
Gyroscope
ARM
DMP
DSP

The IoT Economy

sensing the FUTURE



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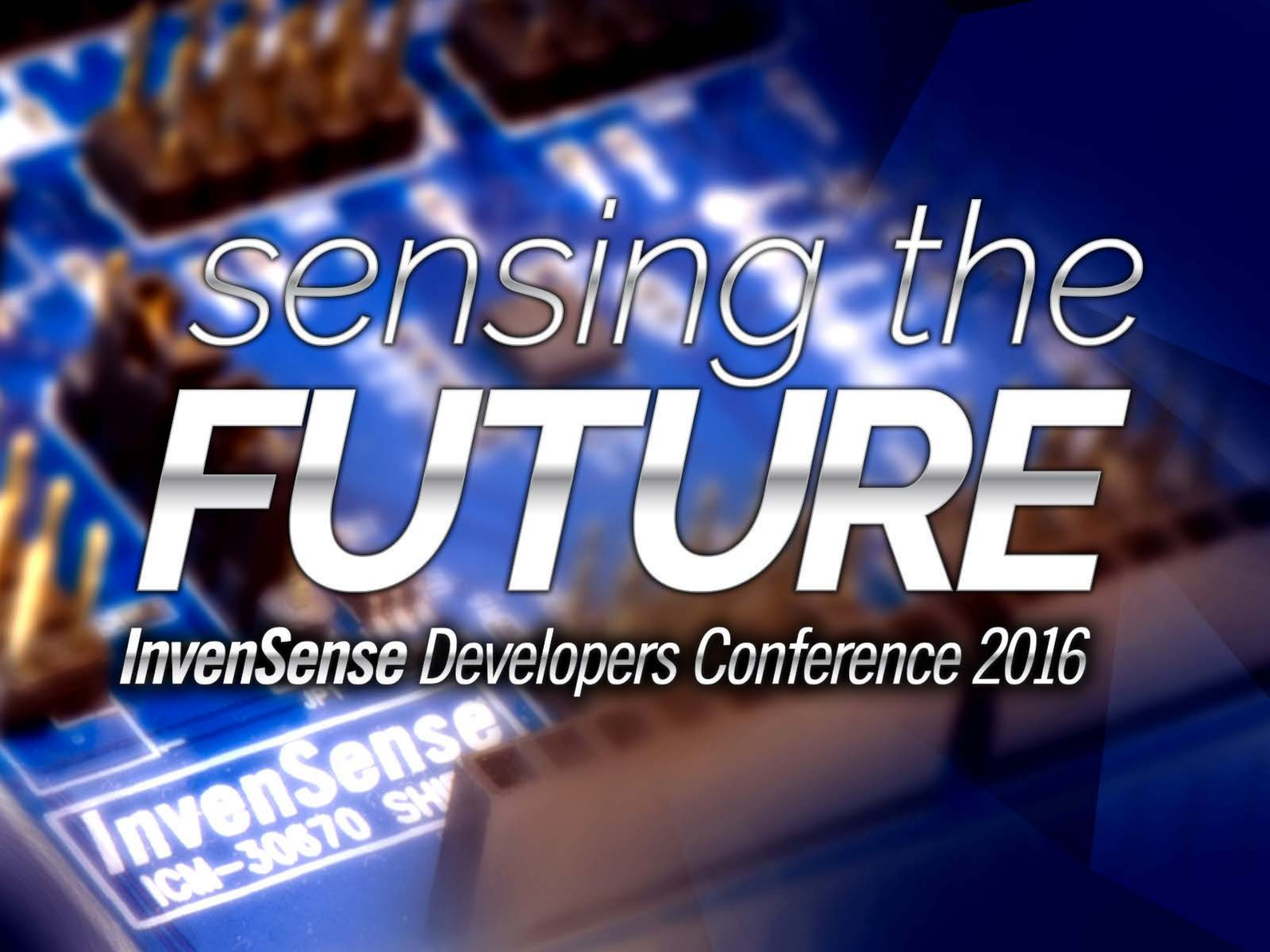
Thank You


sensing the
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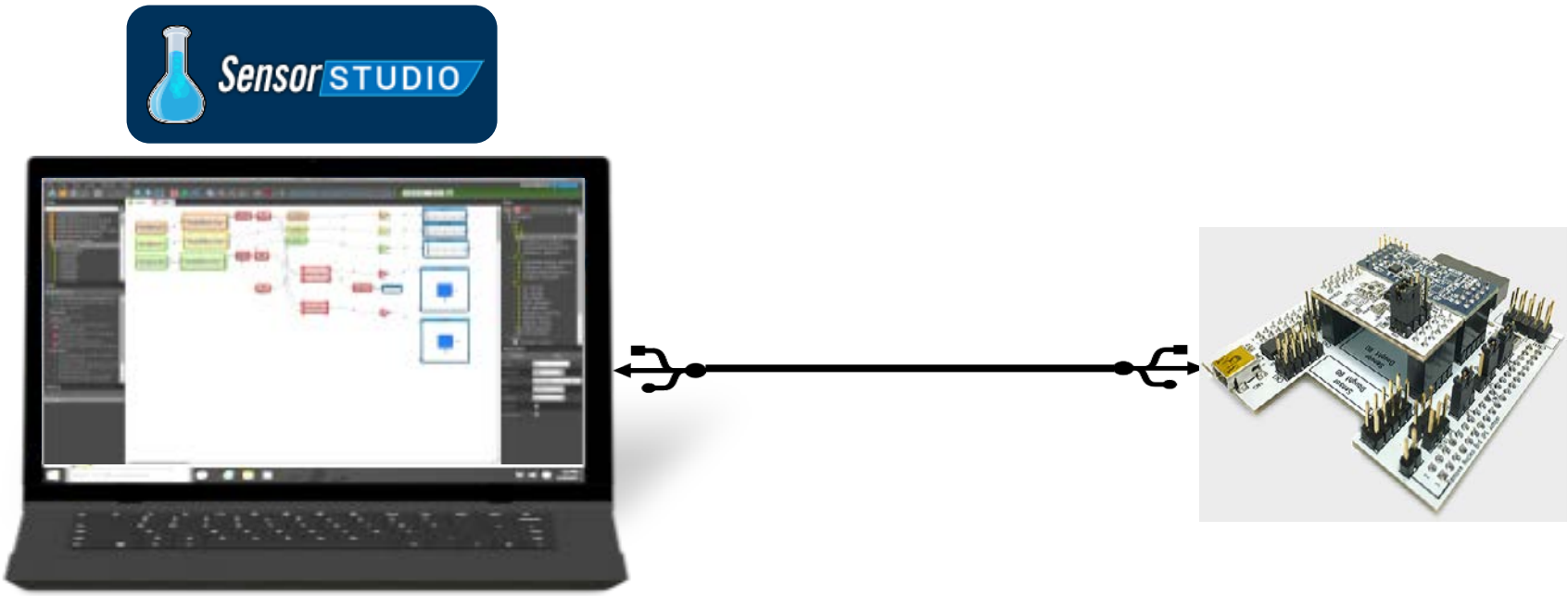
Sensor Studio

Accelerate IOT TTM

SensorStudio Platform

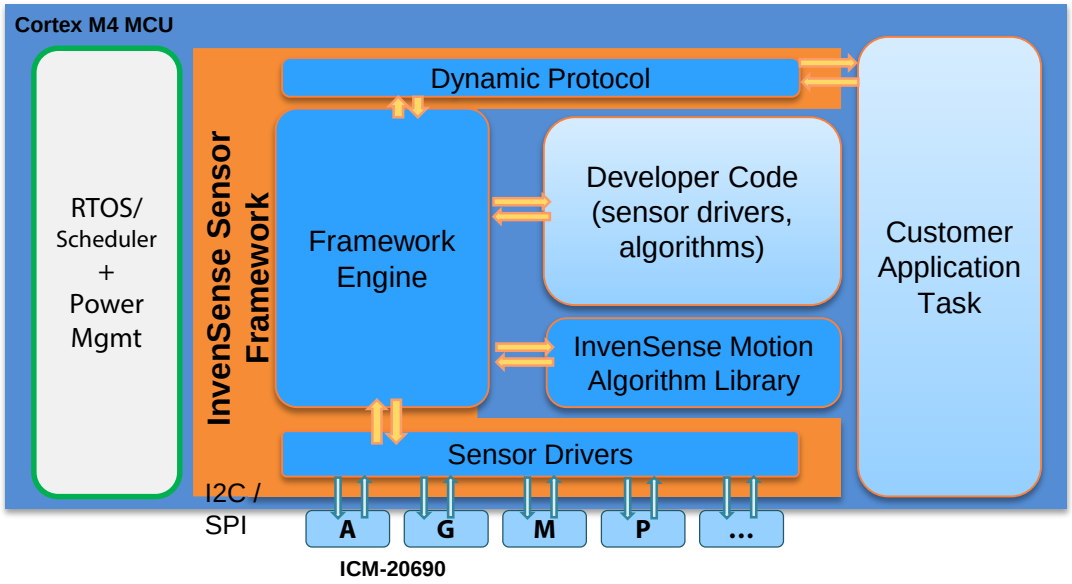


- A sensor algorithms development platform for IOT
- Graphical User Interface
- Open Hardware - Any M4-based SoC
- Extend framework with your own sensors & fusion algorithms
- Sensing Idea → Prototype → Get Funding → Production

GenericSensorHub on Nucleo

sensing the FUTURE

- ✓ Robust sensor framework
- ✓ Rapid implementation
- ✓ Optimized for low-power
- ✓ Extensible for any sensor



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Software Features

sensing the FUTURE

- Feature running on Cortex M4, selectable and power/code optimized
  - Motion
    - Calibrated Acc
    - Calibrated Gyro
    - Calibrated Mag
    - Linear Acceleration
    - Gravity
  - Orientation
    - Game Rotation Vector (AG-Orientation)
    - Rotation Vector (AGM-Orientation)
    - Orientation (AGM-orientation reported as yaw/pitch/roll angle)
    - Geomag Rotation Vector (AM-Orientation)
  - Gestures
    - SMD (Significant Motion Detector)
    - Pickup
    - Tilt
  - Activity Classification
    - Step Detector
    - Step Counter
    - Basic Activity Classifier (Still, Walk, Run, Biking)
  - Pressure sensor
  - Proximity sensor
  - Easily add your own Sensor

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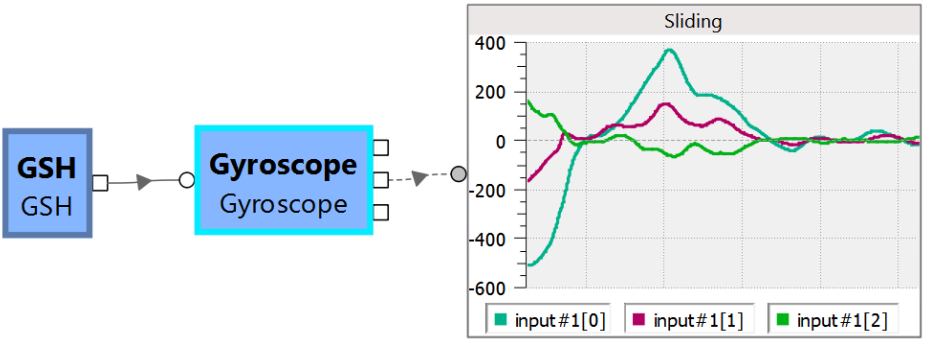
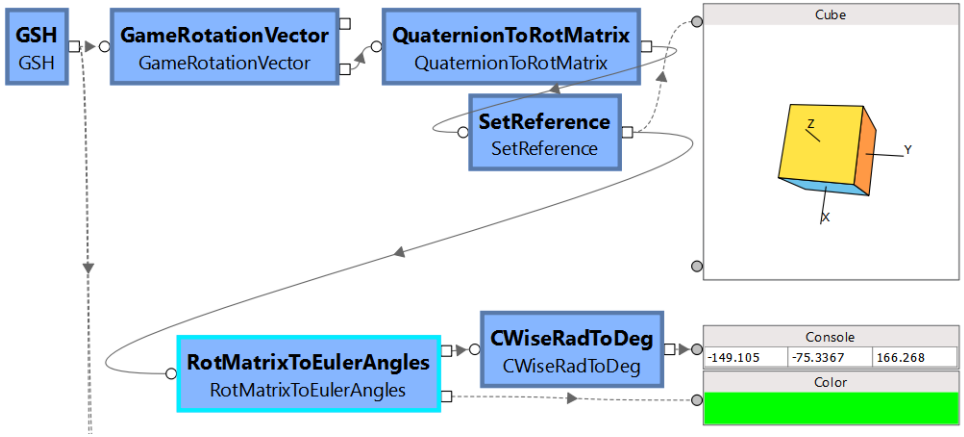
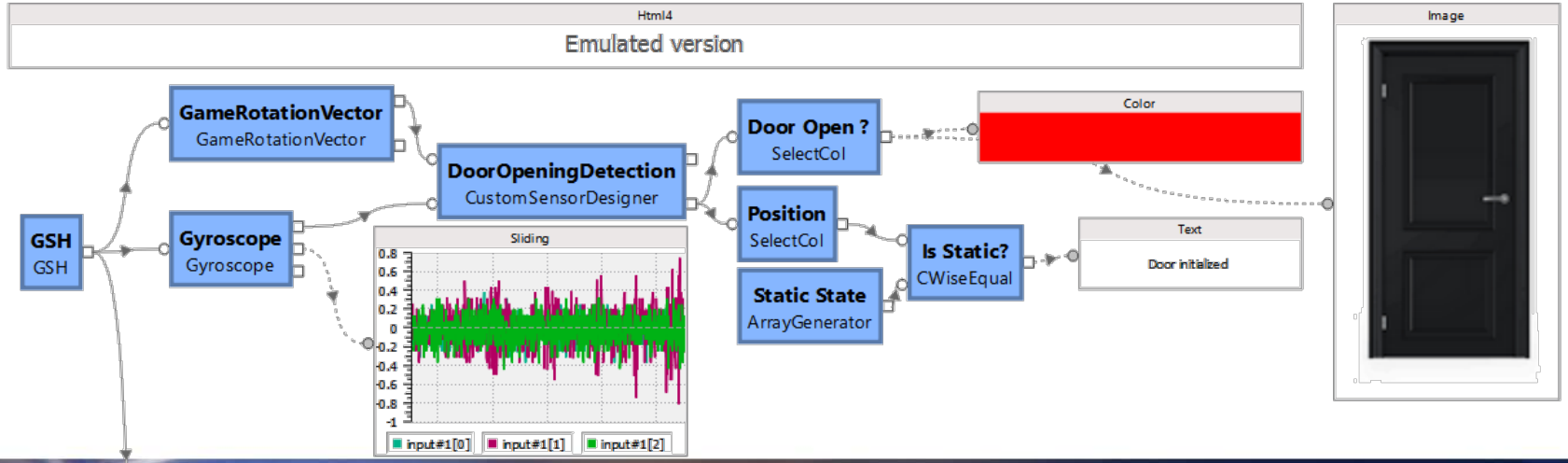
Visualize all signals Real-Time

sensing the FUTURE

- Different visualizations types
- InvenSense sensors & sensor fusion, your own!







Easily add sensors & algorithms

sensing the FUTURE

- Data synchronization is taken care off
- Focus on your new sensors and algorithms!
- Record & Replay → Validate & optimize

DoorOpeningDetection.ImplCode - C Editor

API Documentation | Search _Replace | Line: 1 | Go | Word wrap | Errors (0)

```
/**
* Called when sensor#0 push an event.
* Sensor#0 is defined according to what is connected to input pin SensorHandle#0
* of this designer block.
*
* @param timestamp
* @param data pointer to data event from sensor#0 (orientation)
* @param len data size of this event (in bytes)
*/
static void game_rotation_vector_data_event(uint32_t timestamp, void* data, uint16_t len)
{
        float32_t dataQuaternionQuat[4];
        float32_t quat_tmp[4]={0};
        float32_t sinAngleHalf;
        float32_t rotationAxisZ;
        float32_t sinAngleHalfSqr;

        assert(len == sizeof(VSensorDataQuaternion));
        VSensorDataQuaternion* q = (VSensorDataQuaternion*) data;

        // decimate by skipping events
        if (--sw_decimator.cnt >= 0)
                return;
        // reset the decimator counter
        sw_decimator.cnt = sw_decimator.rate;
```

Ln : 1 | Col : 1

Close | Apply

AuxiliarySensorDesigner.ImplCode - C Editor

API Documentation | Search _Replace | Line: 1 | Go | Word wrap | Errors (0)

```
/**
 * Code for the custom task that will retrieve data from the AK09911
 */
static void MyCustomTaskCode(void * arg)
{
        /* get current system time in tick */
        uint32_t t = inv_shext_get_systick();
        int16_t sample[3];

        /* retrieve sensor data */
        ak09911_get_sample(sample);

        /* notify data to the outside world */
        notify(t, sample, sizeof(sample));

        /* The HW sensor performs a single acquisition, so ask for another one */
        ak09911_start_single();

        (void)arg; /* arg contains the value passed on inv_shext_task_create() */
}
```

Ln : 1 | Col : 1

Close | Apply

Thank You